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Remarks
ON
OCULAR SYMPTOMS IN CEREBRO-SPINAL MENINGITIS.

NOTES BASED ON THE EXAMINATION OF 73 CASES.

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THROUGH the courtesy of the superintendents and staffs of the Glasgow Fever Hospitals, the writer has, within the last few months, had opportunities of investigating the condition of the eyes in a number of cases of cerebro-spinal meningitis. Adding to these a few cases seen elsewhere, the total number of cases examined amounts to 73.

As clinical reports embracing the details of the eye conditions in this disease have not been numerous, it may be of interest to give an account of the symptoms found in the present series of cases.

In each case where possible a complete examination was made, but it will be readily understood that often, especially in young children who were acutely ill, many points had to be omitted.

The series includes cases in all stages of the disease, from acute cases seen on the second day of illness to others which had long before subsided into a state of chronic hydrocephalus. One of the latter cases was first seen in the thirtieth week of the disease. The ages of the patients ranged from 3 months to 47 years.

Eye symptoms of any kind were absent only in 4 cases; of these 2 were convalescent. The others were seen on the sixteenth and sixty-fourth day respectively.

EYELIDS.

The only lesion found on the lids themselves was an eruption of herpes on both lids of one eye, in an acute case at the end of the first week of illness.

Abnormalities of the palpebral fissures were noted in 17 cases. In 2 of these the only abnormality was inequality. In 2 cases the palpebral fissures were abnormally wide and at the same time unequal. In another,

who had alternations of retraction and drooping of the lids, the inequality of the palpebral fissures disappeared when the lids were in a state of retraction. In another similar case the inequality was present both with drooping and with elevated lids. In this one the inequality was perhaps due to weakness of the orbicularis, since voluntary efforts caused only partial closure of the wider palpebral fissure.

In none of the cases was there a drooping of one or both lids which could be described as ptosis.

Retraction of the Eyelids.

This was observed in 15 cases. It was observed as early as the fourth day, but most of the cases in which the symptom was well marked were cases which had passed into the chronic stage. The most marked case of all, in which sclera was well exposed both above and below the cornea, was that of a boy, seen the day of his death, who had been long in the chronic hydrocephalic state. *Post mortem*, no trace of exudate was found, but a great excess of clear fluid both in the ventricle and in the subarachnoid space. The patients in whom the symptom was observed in the early acute stage (4 in number) all died in the acute stage. Seven of the 11 chronic cases have already died; 1 has definitely recovered; the other 3 are still in hospital. The case in which recovery took place is of some interest. The writer first saw her on the fifty-fourth day. She was then convalescent, but four weeks earlier she had had all the appearance of a chronic case likely to prove fatal. The retraction of the upper lids was very marked, 2 or 3 mm. of sclera being visible above each cornea. It was fairly constant, was still present a week later, but had disappeared by the sixty-seventh day. The retraction of the lids in this case was accompanied by typical von Graefe's sign.

In 12 patients retraction of the lids was associated with dilated pupils, in which the light reflex was absent or very defective. In 1 case the pupils were small and inactive. In the other 2 cases the pupils were not investigated. In 3 it was associated with absence of the cilio-spinal reflex. In a fourth the latter was present in a slight degree.

Retraction of the lids was seldom a constant symptom, and it nearly always disappeared while the patient was asleep. In 1 case, in addition to the retraction of the lids a degree of exophthalmos seemed to be present.

Taking into consideration the facts above mentioned as to the further history of the cases in which this symptom was found, it would seem to be confined to cases in which the chance of recovery is small.

The cause of retraction of the lids is obscure. It is a recognized symptom of chronic hydrocephalus, and the majority of the cases above referred to might come under that heading.

In the acute cases it was never quite so marked, and in these cases it might be due to sympathetic irritation,

either in the cilio-spinal centre or elsewhere in the sympathetic path to the eye. The dilated inactive state of the pupils would be quite in keeping with such an explanation. It is scarcely likely that sympathetic irritation plays a part in producing lid retraction in the later stages, in which the symptoms as a whole are referable more to the abnormal physical condition set up in the cerebro-spinal system than to inflammatory action. Tooth[1] has suggested that it is a local manifestation of muscular rigidity analogous to head retraction, Kernig's sign, etc. The case I have mentioned, in which the symptom persisted well into the stage of convalescence, may lend some support to this, as it is not uncommon for stiffness of the neck and other manifestations of muscular rigidity to persist in a similar way after the patient is in other respects well. Increased intracranial pressure may be a necessary element in its causation. This is suggested by the frequency of its occurrence in chronic hydrocephalus from other causes. In 1 case of the present series the retraction, which was occasional, was associated with wrinkling of the forehead and complaint of increased frontal headache, and at the same time the eyes were turned strongly downwards and the pupils dilated and inactive.

Blepharospasm.

This was very frequent. In the great majority of the cases general hyperaesthesia was a marked symptom, and in the course of the eye examination this showed itself in the occurrence of a strong lid spasm, sometimes excited by the lightest touch upon the lids, more generally by attempts to separate the lids. This at first sight suggested photophobia and is probably the symptom sometimes described as such in cases of cerebro spinal meningitis, but the writer never observed true photophobia in this series of cases. Spasmodic resistance to separation of the lids was almost the rule, but the patients could often be induced to open the eyes spontaneously, after which even prolonged ophthalmoscopic examination was tolerated so long as the lids were not touched. The absence of true photophobia is somewhat remarkable in view of the great general hyperaesthesia which is present in most of the cases. In one or two early acute cases the lightest touching of the eyelids set up a spasm of all the facial muscles. These occurrences were just as marked in unconscious as in conscious patients.

As a rule reflex blinking occurred on lightly stroking the eyelashes. Its absence was observed only in one hydrocephalic case a few days before death.

In one child who had repeated convulsive attacks, the left eyelids were involved in clonic spasms which affected the left side.

In 4 cases frequent winking was noted, each lid movement being accompanied by a jerky nystagmus-like movement of the eyeballs laterally or vertically.

Conjunctiva.

Hyperaemia of the bulbar and palpebral conjunctivae occurred in many of the cases. A certain degree of bulbar injection is quite common, even in the first few days of the disease, and it may persist for some time.

Actual catarrhal conjunctivitis, with more or less purulent discharge, was found in 13 of the cases. In the majority it was a symptom of the early acute stage, but in several where it was first observed in the later stages, it might quite well have been due to outward infection from the incomplete closure of the lids, associated with a state of unconsciousness. No attempt was made to work out the bacteriology of these discharges. In the films taken from a few cases a number of organisms were found, but none closely resembling the typical meningococcus. Axenfeld, in his recently-published work on the bacteriology of the eye, points out the difficulty of proving the identity of the meningococcus in conjunctival discharges, and indicates that only a few unequivocal positive findings have been made. Among these is that of J. Canby Robinson,[2] who succeeded in cultivating the meningococcus from the discharge in one case of acute cerebro-spinal meningitis.

Conjunctival haemorrhages do not seem to have been hitherto described in cerebro spinal meningitis, although haemorrhages corresponding with the petechiae in the skin are known to occur in many other situations throughout the body. Dr. Macgregor of Belvidere, who mentioned the symptom to me, saw conjunctival haemorrhages quite frequently in the earlier cases of the Glasgow epidemic, usually in the acute stage, and even in the absence of such spots in the skin. I saw them in 2 cases of this series, one on the fourth day of the disease, no haemorrhagic skin rash being present; the other on the day of death (thirty-fourth day of illness) associated with an abundant crop of cutaneous haemorrhages. In 2 other cases of the series conjunctival haemorrhages had been present at an earlier period (third day and fourth day respectively), but had faded by the time of my examination. As conjunctival haemorrhages are rare in acute illnesses, with the exception of whooping-cough, their presence in a patient suspected to be suffering from cerebro-spinal meningitis should carry a certain weight.

Cornea.

In only 1 case was a corneal lesion present. This was a child seen the day before death—tenth day of illness. She lay unconscious, with eyelids half closed; winking movements were infrequent and incomplete; the corneae were rather insensitive, and each cornea presented a horizontally oval *ulcer* in its lower segment, obviously due to exposure. There was also abundant sero-purulent discharge.

The *corneal reflex* was tested for in 25 cases. It was only found to be quite absent in 1, in which the other eye reflexes also were absent or very deficient. In 2

others the corneal reflex was present but deficient, 1 of these having corneal ulcers already referred to. Death occurred in these 3 cases.

Uveal Tract.

No evidence of iritis, cyclitis, or choroiditis was found in any of the cases.

Pupils.

Abnormalities of the pupils were the most common symptoms. Thus only 6 out of 69 cases in which the pupils were examined had no pupillary abnormality. Three of them were acute cases in the fifth, tenth, and sixteenth days respectively.

Inequality of the pupils was noted eighteen times. In the great majority of cases where the pupils were unequal the pupil reflexes were deficient. In 2 of them one pupil showed the striking changes of size which will be referred to later, while the other pupil was more constant in size. In several others the reflexes were more active in one iris than in the other.

The size of the pupils was measured in 65 cases. Taking 3 to 5 mm as the normal limits, dilated pupils were found in 34, contracted in 5, and normal in 26. When mydriasis was present, it usually had the characters of an "irritation" mydriasis, that is, dilated pupils with deficient contraction to light and in convergence, and no dilatation to sensory stimuli. In 2 of the cases, to these features was added some retraction of the eyelids. Further evidence of a hypersensitive condition of the sympathetic reflex was afforded by the striking contrast in the size of the pupils in the waking and sleeping states. Pupils which during sleep were as small as 2 5 or 3 mm., would dilate on waking to about 7 mm. This is a larger change than would occur under normal conditions.

Changes in the size of the pupils were common. These were often merely due to *hippus* of the ordinary kind, a certain degree of which is often found in normal persons, but in many there were much larger changes of diameter, which occurred at intervals of seconds or minutes or even longer, and various gradations were found between the latter phenomenon and ordinary hippus. On the whole, the hippus observed in this series of cases was of greater amplitude than normal, and inclined to persist as long as illumination of the eye was maintained. It showed great variety in speed, in rhythm, and in amplitude, even in the same case. Hippus was noted as present in 31 and absent in 19 cases. The other phenomenon referred to was present in 29 cases. Many of these cases showed hippus, as well as the more occasional and more striking changes of diameter. These changes of diameter often had a range of 3 mm. or more. In 2 cases they were more distinct in one eye than in the other. They occurred independently of the illumination or distance of fixation object. Thus they sometimes

occurred with perfectly steady fixation during indirect ophthalmoscopic examination. In the middle of such an examination the pupil, which had been widely dilated, would suddenly and unexpectedly contract, and after an interval of seconds or minutes dilatation would occur again just as unexpectedly. This symptom, however, is not peculiar to cerebro spinal meningitis. The writer has seen it in several cases proved by *post-mortem* examination to have been tuberculous.

Pupil Reflexes.

The light reflex was normal, or nearly so, in 24 cases, deficient as regards speed or amplitude or both in 26, absent in 7, and variable in its activity in 11.

The contraction of the pupil in *near vision* was good in 21, deficient in 15, absent in 7, and variable in 2. In 5 of the cases with deficient or absent reflex there was a corresponding deficiency of the faculty of convergence, which would account for the defect. The test for the convergence reflex could not be quite satisfactory, the results depend so much upon the visual acuity and the mental condition of the patient. It was sometimes found, for instance, that while a child manifested no convergence or pupil contraction on being asked to fix the finger tip or handle of the ophthalmoscope, these reflexes were immediately elicited by a more interesting fixation subject, such as a penny.

The cilio-spinal reflex was present eighteen times and absent fourteen times.

The orbicularis reflex was present five times and absent seven times.

The pupil changes described by Squires[3] as found in cases of basal meningitis (contraction when the head is flexed and dilatation when it is extended) were looked for in 3 cases, but not found.

Total absence of pupil reflexes with contracted (2 mm.) pupils was observed in 1 case on the day of death.

In some cases the activity of the reflexes varied in the course of the examination without obvious cause. In 1 case Cheyne-Stokes respiration was present at the time of examination, but no pupil changes were found to correspond with the different phases of the respiration.

None of the pupillary phenomena, with the exception of total absence of the reflexes, seemed to be of any value as regards diagnosis or prognosis.

Accommodation.

It was only possible to test the accommodation in 7 cases, and in none of them was it defective.

Strabismus.

Strabismus was found in 15 cases. Eight others had a history of squinting or diplopia, either before or after admission to hospital.

It is noteworthy that in only 1 of the 15 cases observed by the writer was evidence found that the squint was a paralytic one (paralysis of both external recti). This contrasts with the state of affairs in other forms of meningitis, tuberculous for example, in which paralytic squints are much more common.

It was difficult in some cases to say whether the squint had existed at an earlier date or was a symptom of the disease. In 1 case, although the amplitude of the squint (convergent) varied from time to time, the fact that the eyes moved conjugately, with no apparent limitation in any one direction, suggested that it was a pre-existing concomitant squint.

In 3 others convergent squinting alone was observed. It was spasmodic in character, not constantly present, and varying in degree. In 1 of these cases the squinting eye sometimes turned into its position of greatest convergence by a series of rapid jerky movements. This patient who died three days after the observation, was found to have suffered from a combination of tuberculous and meningococcal infection.

In the other 10 cases the squint was either entirely divergent or varied from convergence to divergence. All were variable in degree and not constantly present. In some the condition was quite evidently a spasmodic one, passing from one eye to the other, or affecting both eyes simultaneously. Some of these cases might perhaps be better described as examples of dissociated movements, since various degrees of convergence and divergence occurred in rapid succession, owing to independent movements of the eyeballs.

In 4 cases of divergent strabismus, the divergence only occurred when the patient was unconscious or asleep. These were probably only examples of the divergence which constitutes the resting position of the visual axes.

From the histories of cases of cerebro-spinal meningitis, it would seem that squints of various kinds, transient and probably spasmodic, are not uncommon among the symptoms of the period of onset.

The Ocular Movements.

The *conjugate movements* of the eyes were noted as normal in 41 cases.

Constant conjugated *rolling of the eyes* from side to side was present in 1 case in the hydrocephalic stage.

Conjugate deviation of the eyes was found in 4 cases. In 1 of these it occurred in the course of a unilateral convulsion, at first towards the convulsed side, and later towards the unaffected side.

Convergence was normally performed in 25 cases, deficient in 9 and absent in 3. Two of the deficient cases were myopic. In some the defect was due to mental apathy, in others to visual defect making the test unsatisfactory. Often there was a combination of

these two circumstances. This difficulty has already been noticed in connexion with the reflex contraction of the pupil in near vision.

Nystagmus was found 7 times. In 2 of these it was *vertical* and occasional; in 1 it was vertical and constant. In 1 case rotary nystagmus was found. In 1 of the cases exhibiting occasional vertical nystagmus and in 3 others a symptom was present which consisted of rapid winking movements of the lids, each wink being accompanied by a jerky movement of both eyes to one or other side or even in a vertical direction. Nystagmus seems to occur only in severe cases. Of the 7 in whom it was observed 2 had relapsed into the chronic stage, and the other 5 died a few days after the symptom was noted.

Pseudo-nystagmus, or jerky movement of the eyes at the limits of the field of fixation, was seen in 5 cases. It appeared to have no significance.

Vision.

It was often very difficult to get any reliable information as to the state of vision, but when the patient could not be tested with types, he was considered to have good vision if he recognized small objects, followed the finger, etc.

In this sense vision was good in 34, in 12 it was defective, in 9 absent, and in 7 it varied between very deficient and absent in the course of the examination. One case of defective vision was a high myopia with choroidal atrophy.

The visual defect was seldom to be entirely explained by any condition discovered by the ophthalmoscope, but in 2 cases in which vision was abolished there was optic neuritis. In a third the discs were congested, their margins blurred. and the veins full.

The cause of the visual defect in most of the cases must probably be looked for in the higher centres, although amblyopia or amaurosis was never found associated with perfect pupil reactions.

None of the convalescent cases in this series had any notable defect of vision.

Ophthalmoscopic Changes.

Ophthalmoscopic examination was made in 61 cases.

Double optic neuritis, well marked, was found in 5 cases.

One of these, who was seen on the fourteenth day of his illness, died on the seventeenth day, and was found *post mortem* to have been suffering from a combination of tuberculous and diplococcal meningitis.

Another, a boy of 11, after apparent recovery, had relapsed into a chronic illness, with repeated attacks of sickness, head retraction, and other symptoms. The optic neuritis was seen at two examinations on the twenty-second and forty-third days respectively.

The third case, a man of 21 years, when first seen (on the thirtieth day of his illness) was apparently conva-

lescing, but he suffered a relapse. On the forty-ninth day the posterior fossa was trephined for drainage. Ophthalmoscopic examination was repeated on the fifty-first day, and the optic neuritis found to be unchanged.

The fourth case was a child aged 4, who had been in hospital for about four months at the time of the examination. *Post mortem* he was found to have marked internal hydrocephalus.

The fifth case was a man aged 20, whose history was that he had suffered for some weeks from indefinite symptoms of illness, chiefly pains in the head and neck, attributed to influenza. Sudden increase in the severity of the symptoms caused him to leave work and seek admission to hospital. The ophthalmoscopic examination was made on the twelfth day of the acute illness. Besides the well-marked double optic neuritis, there was in the left eye a moderately large flame-shaped haemorrhage passing across the upper inner edge of the swollen disc.

Besides the 5 cases of well-marked optic neuritis there were 9 cases in which blurring of the disc margins, congestion of the discs, and fullness or tortuosity of the vessels raised a suspicion of optic neuritis. These observations were made at periods ranging from the fifth day (3 cases) to the one hundred and eighty-first day, and they were not cases of unusual severity. In the very chronic case referred to, the swelling of the optic nerve, which was definite though slight, was more marked in the right eye, and was not always present to the same degree.

In a number of patients the fundus presented the highly-coloured disc, full veins, and tortuous arteries so often met with in fever from any cause. In 2 of the 5 cases of optic neuritis the vision was defective; in 2 of them absent. Among the 9 other cases the vision was, on the whole, poor, but not more so than among all the cases of the series

In 2 cases, one of them highly myopic, extensive choroidal atrophy of old standing was present. With the exception of the retinal haemorrhage already mentioned, no other abnormality of the fundus was observed.

In no case was there any obscuration of the fundus from disturbances of the media other than corneal nebulae which existed prior to the present illness.

Conclusion.

It will naturally be asked whether the ocular symptoms of cerebro-spinal meningitis are likely to afford any help in diagnosis or prognosis. The frequency of the presence of eye symptoms shows that it is worth while to have the eyes frequently and carefully examined.

Perhaps the most striking feature of these cases is the great variation in the symptoms—squint, retractions of the lids, sizes and reactions of the pupils, vision, etc.—in the same patient from day to day, and even in the course of a single examination. This is brought out by the records of the writer's own examinations as detailed above, but even more markedly by comparison of these with the notes made from time to time in

the hospital journals. In this respect cases of cerebro-spinal meningitis seem to the writer to differ somewhat from other forms of meningitis.

As conjunctival haemorrhages, so far as one is aware, do not occur at the onset of other acute febrile illnesses, their presence might afford a useful aid in diagnosis. The same may perhaps be said of herpes of the lids. This has been seen to occur, and it is quite conceivable that it might occur on the eyelids alone or even on the cornea, among the earlier symptoms.

The conjunctivitis, which also occurs as an early symptom, would be most likely to assist in distinguishing cerebro-spinal from other forms of meningitis. Unfortunately the examination of conjunctival smears for the organism is of little value, as nothing short of careful cultural tests is sufficient to prove the identity of the meningococcus in these discharges.

Comparing cerebro-spinal with tuberculous meningitis, the infrequency of paralytic squint and optic neuritis, and the comparative frequency of spasmodic squints and dissociated movements are somewhat striking. It is probable also that defect or absence of vision without ophthalmoscopic changes is more common than in the tuberculous form.

With regard to prognosis, it is perhaps impossible to gather reliable data from such a limited series of cases, but the writer would express the opinion that retraction of the eyelids, corneal complications, absence of the pupil reflexes, true nystagmus, lid winking combined with jerky movements of the eyes, and optic neuritis, are among the symptoms of graver significance.

The absence of ocular symptoms does not, of course, justify a favourable prognosis.

In conclusion, the writer desires to express his special obligation to Drs. Macgregor, Connal, and McPhee for their assistance in carrying out these examinations.

REFERENCES.

[1] H. Tooth, BRITISH MEDICAL JOURNAL, October 21st, 1905. [2] J. Canby Robinson, *Bulletin of Ayer Clinical Laboratory*, Philadelphia, 1906. [3] Squires, *Medical Record*, March 26th, 1904.